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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/493,983	01/28/2000	Hirokazu Yashiro	1018.1117101	2906

7590 04/03/2002

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EXAMINER	
MULLINS, BURTON S	

ART UNIT	PAPER NUMBER
2834	

DATE MAILED: 04/03/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/493,983	YASHIRO ET AL.	
	Examiner	Art Unit	
	Burton S. Mullins	2834	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 February 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) *17-27* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

BURTON S. MULLINS
PRIMARY EXAMINER

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1-7 and 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al. (US 5,089,732) in view of Weilbach et al. (US 5,019,738). Konno teaches the basic spindle motor shaft and cylindrical radial bearing (Fig.6) comprising: cylindrical rotary member 7 attached to rotary shaft 6b; a cylindrical fixed surface 2 surrounding the rotary member 7, wherein the fixed surface 2 is spaced from the rotary member 7 by a predetermined distance (determined by the radial bearing 4); and armature coils 5 arranged about a peripheral surface of the fixed surface 2 to rotate the rotor 6, and thus the shaft 6b.

Konno does not teach that the rotary member has a coefficient of thermal expansion smaller than that of the fixed surface.

Weilbach teaches a motor bearing arrangement comprising a rotary shaft 46 and a surrounding cylindrical bearing sleeve 40 which forms a bearing surface 48 therebetween. As shown in Table 1 (c.6), the shaft may be of ceramic while the sleeve is of hard anodized aluminum, i.e., alumina or aluminum oxide. Also, the shaft can be of ceramic while the sleeve is steel. Ceramics such as silicon carbide have lower coefficient of thermal conductivity, usually 3-4 x 10^{-6}/ C, smaller than the thermal conductivity of most steels, e.g. 110 to 170 x 10^{-6}/ C (see http://www.sni.net/~fjlawson/matlprops.html#thermal_exp). The combinations in Table 1 of Weilbach are successful bearing arrangements which conform to

roughness profiles that provide high precision bearings with various beneficial operating characteristics such as high stiffness, low velocity lift, etc. (c.2, lines 23-64).

It would have been obvious to one having ordinary skill in the art to provide a ceramic material with a low coefficient of thermal expansion per Weilbach as the material for the cylindrical rotary member of Konno since this would be desirable to provide a high precision bearing.

Regarding claim 2, the difference in thermal expansion between ceramic and a typical steel as taught in Weilbach is much greater than the claimed minimum value.

Regarding claims 3 and 9, the value for a typical ceramic such as silicon carbide used as the rotating shaft in Weilbach is typically 3-4 x 10^{-6}/ C .

Regarding claims 4-5, hard anodized aluminum, or alumina, is taught as the sleeve surface in Weilbach.

Regarding claims 6-7 and 10-11, note that the rotary member in Weilbach can be made of a ceramic. Ceramics include ceramic carbide material such as silicon carbide (see Konno '173, c.14, lines 65-67).

3. Claims 8 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al. (US 5,089,732) and Weilbach as applied to claims 1 and 9 above, and further in view of Conrad (US 5,707,213). Neither Konno nor Weilbach teach a case accomodating the bearing, rotary member and fixed surface, wherein the case has a slit for cooling these elements.

Conrad teaches a molecular vacuum pump including a case surrounding the stator windings (drive 7), bearings 8/9 and pump rotor/stator 2/3. The case includes slits comprising inlets 12-14 for cooling gas which cools the pump (c.3., lines 5-10).

It would have been obvious to one having ordinary skill in the art at the time of the invention to modify the structure of Konno and Weilbach and provide a case accomodating the bearing with slits per Conrad since it would have been desirable to cool the motor.

4. Claims 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konno et al. (US 5,089,732) in view of Weilbach et al. and Yashiro (JP 2-16389). As discussed above, Konno teaches the general cylindrical bearing structure.

Konno does not teach that the rotary member has a coefficient of thermal expansion smaller than that of the fixed surface. Neither does Konno teach a turbo-molecular pump, per se.

Regarding the former feature, Weilbach teaches a motor bearing arrangement comprising a rotary shaft 46 and a surrounding cylindrical bearing sleeve 40 which forms a bearing surface 48 therebetween. As shown in Table 1 (c.6), the shaft may be of ceramic while the sleeve is of hard anodized aluminum, i.e., alumina or aluminum oxide. Also, the shaft can be of ceramic while the sleeve is steel. Ceramics such as silicon carbide have lower coefficient of thermal conductivity, usually 3-4 x 10^{-6}/ C , smaller than the thermal conductivity of most steels, e.g. 110 to 170 x 10^{-6}/ C (see http://www.sni.net/~fjlawson/matlprops.html#thermal_exp). The combinations in Table 1 of Weilbach are successful bearing arrangements which conform to roughness profiles that provide high precision bearings with various beneficial operating characteristics such as high stiffness, low velocity lift, etc. (c.2, lines 23-64).

Regarding the latter feature, Yashiro teaches a turbo-molecular pump including rotor 17, rotor vanes 16, stator or housing 11, stator vanes 19, and motor 13/14 for rotating the

rotor. Yashiro also teaches non-contact, ceramic cylindrical bearings (Figs.4-5; specification, p.1-p.4) for radial and thrust bearings. A fan is also included for cooling the air bearing, as discussed at p.3, line 27 of the specification with regard to Yashiro.

It would have been obvious to one having ordinary skill in the art to provide a ceramic material with a low coefficient of thermal expansion per Weilbach as the material for the cylindrical rotary member of Konno since this would be desirable to provide a high precision bearing. It would furthermore have been obvious to employ the bearing on a turbo-molecular pump because high precision would be desirable in high-speed applications such as the turbo-pump in Yashiro, which also uses cylindrical bearings.

Response to Arguments

5. Applicant's arguments filed 2-22-02 have been fully considered but they are not persuasive. Regarding claims 1-7, 9-11 and 13-16, in response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Weilbach provides ample motivation for using a material, e.g., ceramic, for the shaft having a smaller coefficient of thermal expansion than a material, e.g., hard anodized aluminum, used for the sleeve, since Weilbach specifically cites this combination in Table I and states that "[s]pecially, the material

combinations listed...have found to provide successful bearing surfaces for use in the present invention" (c.6, lines 1-4). A "successful bearing" in Weilbach would exhibit the desired qualities described at c.2, lines 23-64, e.g., high stiffness or low velocity lift. If Weilbach intended only that the materials of the bearing sleeve and shaft had matched coefficients of thermal expansion, why would Weilbach explicitly provide examples in Table I which show ceramic (thermal conductivity $\approx 3 \times 10^{-6}$/°C) used on the shaft and hard anodized aluminum (thermal conductivity $\approx 110 \times 10^{-6}$/°C) for the sleeve? Why would Weilbach state that this combination would "provide successful bearing surfaces?" Further, the fact that Weilbach teaches a steel sleeve and a ceramic shaft combination in Table I does not diminish the fact that Weilbach teaches in the same table a ceramic sleeve and a steel shaft combination. The argument that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

Applicant's arguments with respect to claims 8 and 12 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Burton S. Mullins whose telephone number is 305-7063. The examiner can normally be reached on Monday-Friday, 9 am to 5 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nestor Ramirez can be

reached on 308-1371. The fax phone numbers for the organization where this application or proceeding is assigned are 305-1341 for regular communications and 305-1341 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 308-0956.

Burton S. Mullins
Primary Examiner
Art Unit 2834

bsm
April 1, 2002